

### HSPE Item Specifications

“Enduring and Important Knowledge” identified in previous grade-levels may be included within the context of some problems.

Prioritized Standards		Knowledge/Skills Assessed	Item Specifications
<p><b>1.12.1</b> Calculate and estimate sums, differences, products, quotients, powers, and roots using mental math, formulas, and algorithms. (P)</p> <p><b>1.8.2</b> Compute with rational and irrational numbers to solve a variety of problems including rates, recipes, unit costs, and percents (e.g., discounts, interest, sale prices, commissions, taxes). (PS)</p> <p><b>1.12.3</b> Apply the properties and theories of the real number system to everyday situations. (PS)</p> <p><b>1.8.7</b> Estimate in problem-solving situations and in practical applications; determine the reasonableness of the answer and verify the results. ((P, PS)</p>	Concepts		
	Procedures	<p><b>1.12.1</b> Calculate sums, differences, products, quotients, powers, and roots.</p> <p><b>1.8.7</b> Estimate in problem-solving situations and in practical applications.</p>	<p><b>1.12.1</b> Formulas will be assessed with standard <b>2.12.3</b>. <b>Square roots</b> are limited to 1 – 20, 25 and multiples of 10, and <b>cube roots</b> are limited to 1 – 5 and 10 cubed. The laws of exponents will not be assessed.</p> <p><b>1.8.7</b> Use one-step estimation only.</p>
	Problem Solving	<p><b>1.8.2</b> Compute with rational numbers to solve a variety of problems including rates, recipes, unit costs, and percents in real world situations.</p> <p><b>1.12.3</b> Apply properties and theories of the real number system to everyday situations.</p> <p><b>1.8.7</b> Estimate in problem-solving situations and in practical applications; determine the reasonableness of the answer and verify the results.</p>	<p><b>1.8.2</b> Use simple numbers that allow for assessment of applications rather than computations.</p> <p><b>1.12.3</b> Item must involve a real-world situation, not just a question about properties of the real number system. Theories may include magnitude, order and compare.</p> <p><b>1.8.7</b> Answer choices for the item can ask for specific estimations or for a range for estimation, (e.g., less than \$10, between \$10 and \$20).</p>

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<p><b>2.8.1</b> Use inductive reasoning to find the missing term in number and geometric patterns and to generalize basic patterns to the <math>n</math>th term, with and without calculators; use written, oral, and symbolic language to identify and describe patterns, sequences, and functions. (C, P, PS)</p> <p><b>2.12.3</b> Create and use different forms of a variety of equations, proportions, and/or formulas solving for the needed variable as necessary in given situations. (P)</p> <p><b>2.12.4</b> Add, subtract, multiply, and factor (<math>1^{\text{st}}</math> and <math>2^{\text{nd}}</math> degree) polynomials; use simple quadratic equations with integer roots to solve practical and mathematical problems. (P, PS)</p> <p><b>2.12.5</b> Model practical problems from everyday situations with a variety of models that includes matrices, translating among tabular, symbolic, and graphical representation of functions, with and without technology. (C, PS)</p> <p><b>2.8.6</b> Model, identify, and solve linear equations and inequalities; relate this process to the order of operations. (C, P)</p>	Concepts	<p><b>2.8.1</b> Use inductive reasoning to find the missing term in number and geometric patterns and functions.</p> <p><b>2.12.5</b> Model practical problems from everyday situations with a variety of models that includes matrices.</p> <p><b>2.8.6</b> Model and identify linear equations and inequalities.</p>	<p><b>2.8.1</b> Find the missing term in the pattern. Patterns should be numerical only.</p> <p><b>2.12.5</b> Models can include matrices, tables, equations and graphs. Must model problems from everyday situations.</p> <p><b>2.8.6</b> Items must be straight forward. Items may ask students to recognize the model of an equation or inequality or based on the model recognize the equation or inequality. Absolute value equations can be assessed.</p>
	Procedures	<p><b>2.8.1</b> Use inductive reasoning to extend the number pattern and function.</p> <p><b>2.12.3</b> Create and use different forms of a variety of equations, proportions, and/or formulas to solve for the needed variable.</p> <p><b>2.12.4</b> Add, subtract, multiply, and factor (<math>1^{\text{st}}</math> and <math>2^{\text{nd}}</math> degree) polynomials and use simple quadratic equations with integer roots to solve problems.</p> <p><b>2.8.6</b> Solve linear equations and inequalities.</p>	<p><b>2.8.1</b> Extend the pattern in the problem. Patterns should be numerical only.</p> <p><b>2.12.3</b> Items should ask students to solve a multi-variable equation, proportion formula for a specified variable. Equations and formulas should not be widely recognized (<math>d = rt</math>).</p> <p><b>2.12.4</b> Limit to <math>1^{\text{st}}</math> and <math>2^{\text{nd}}</math> degree polynomials only and to solve quadratic equations. Quadratics can be solved from a graph.</p> <p><b>2.8.6</b> Order of operations should be included in the process. Absolute value equations can be assessed.</p>
	Problem Solving	<p><b>2.8.1</b> Generalize patterns to the <math>n</math>th term. (To include functions too.)</p> <p><b>2.12.4</b> Use simple quadratic equations with integer roots to solve practical and mathematical problems.</p> <p><b>2.12.5</b> Translate among tabular, symbolic, and graphical representation of functions.</p>	<p><b>2.8.1</b> Write the rule to generalize the pattern to the <math>n</math>th term. In a problem solving situation, use the rule implied in a practical problem to determine the <math>n</math>th term. Identify the pattern given the rule. Patterns should be numerical only.</p> <p><b>2.12.4</b> Real-word practical mathematical problems may <b>not</b> include perimeter and/or area.</p> <p><b>2.12.5</b> Item needs to be a real-world and contextual problem which can be solved from the use of graphs, tables, and/or charts. Focus should be on translating from one representation to another.</p>

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<p><b>3.7.1</b> Estimate and convert units of measure for mass, and volume within the same measurement system; compare corresponding units of the two systems. (P, PS)</p> <p><b>3.12.2</b> Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. (P, PS)</p> <p><b>3.12.3</b> Distinguish and differentiate among the structures, language, and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. (C, PS)</p> <p><b>3.12.5</b> Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems. (P, PS)</p>	Concepts	<b>3.12.3</b> Distinguish and differentiate measurements of precision or among the language of systems of measures (e.g., linear, square, or cubic).	<b>3.12.3</b> Which measurement is most precise?
	Procedures	<p><b>3.7.1</b> Convert units of measure for mass and volume within the same measurement system (customary and metric).</p> <p><b>3.12.2</b> Use techniques and formulas to calculate and compare rates, distances (<math>d = rt</math>), and temperatures.</p> <p><b>3.12.5</b> Use formulas (indirect measurement) to determine the measure of unknown dimensions angles, areas, and volumes.</p>	<p><b>3.7.1</b> Conversion factor should be embedded in item. Limited to the following: ounces, pounds, and tons; ounces, cups, pints, quarts and gallons; grams, milligrams, centigrams, and kilograms; liters, milliliters, centiliters and kiloliters. Conversions must be made across a minimum of two units.</p> <p><b>3.12.2</b> Temperature items should require students to convert between Celsius and Fahrenheit.</p> <p><b>3.12.5</b> Item should not require the use of trigonometric ratios.</p>
	Problem Solving	<p><b>3.7.1</b> Estimate and convert units of measure for mass and volume within the same measurement system ( customary and metric);</p> <p><b>3.12.2</b> Select and use techniques and formulas to calculate and compare rates, distances (<math>d = rt</math>), and interest.</p> <p><b>3.12.3</b> Solve problems involving accuracy, precision and tolerance.</p> <p><b>3.12.5</b> Use indirect measurement to determine the measure of unknown dimensions to solve problems.</p>	<p><b>3.7.1</b> Conversion factor should be embedded in item. Volume should be interpreted as capacity. Limited to the following: ounces, pounds, and tons; ounces, cups, pints, quarts and gallons; grams, milligrams, centigrams, and kilograms; liters, milliliters, centiliters and kiloliters.</p> <p><b>3.12.2</b> Items can ask to solve for any of the variables within the formula.</p> <p><b>3.12.3</b> Precision problems must involve different units; accuracy problems involve the same units (Give actual object measured and four measurements of the same unit); tolerance can use the symbol <math>\pm</math>.</p> <p><b>3.12.5</b> Item should not require the use of trigonometric ratios.</p>

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<b>4.12.1</b> Identify and use the properties of polygons (including interior and exterior angles) and elements of circles (e.g., angles, arcs, chords, secants and tangents) to solve practical problems. (C, P)	<b>Concepts</b> <b>4.12.1.</b> Identify properties of polygons and elements of circles. <b>4.8.2</b> Identify corresponding parts of congruent or similar shapes. <b>4.12.5</b> Determine slope of a graphed line, determine slope of a line parallel or perpendicular to a line.	<b>4.12.1</b> Properties of polygons should include interior and exterior angles. Elements of circles should include, but not be limited to radius, chord, tangent, secant, arc, central angle. <b>4.12.5</b> Slope may be determined or described as (e.g., positive, negative, zero, and undefined).
<b>4.8.2</b> Apply the properties of equality and proportionality to solve problems involving congruent or similar shapes. (C, P, PS) <b>4.8.3</b> Uses coordinate geometry and models to change scale (enlarge and reduce). (P) <b>4.12.5</b> Use coordinate geometry to graph linear equations, determine slopes of lines, identify parallel and perpendicular lines and find possible solution to sets of equations; use algebraic techniques to solve problems determined by geometric relationships. (C, P, PS)	<b>Procedures</b> <b>4.12.1</b> Use the properties of polygons and elements of circles to solve practical problems. <b>4.8.2</b> Apply the properties of equality and proportionality to solve problems involving congruent and similar shapes. <b>4.8.3</b> Uses coordinate geometry to change scale. <b>4.12.5</b> Identify the graph of a linear equation and visa versa. Find the possible solutions to sets of equations graphed on a coordinate plane.	<b>4.12.1</b> Properties of polygons should include interior and exterior angles. Elements of circles should include, but not be limited to radius, chord, tangent, secant, arc, central angle. <b>4.8.3</b> Scale can either be to enlarge or reduce. Dilations must be centered at the origin. <b>4.12.5.</b> No more than two sets of equations.
<b>4.8.6</b> Form generalizations and validate conclusions about properties of geometric shapes including parallel lines, perpendicular lines, bisectors, triangles and quadrilaterals. (PS)	<b>Problem Solving</b> <b>4.8.2</b> Apply the properties of equality and proportionality to solve problems involving congruent or similar shapes in problem solving situations. <b>4.12.5</b> Use algebraic techniques to solve problems determined by geometric relationships. <b>4.8.6</b> Form generalizations and validate conclusions about properties of geometric shapes including parallel lines, perpendicular lines, bisectors, triangles and quadrilaterals to solve practical problems.	<b>4.8.2</b> Items may include indirect measure. <b>4.12.5</b> Graph must include some sort of geometric figure. <b>4.8.6</b> Items should require students to apply properties of geometric shapes. Statements may ask students to identify the correct conclusion or reason why the statement is true. Problems may be based on an application.

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<b>4.12.7</b> Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry to solve practical problems. (C, P, PS)	Concepts	<b>4.12.7</b> Identify the properties of special right triangles and right triangle trigonometry.	<b>4.12.7</b> Items may ask students to identify attributes of 45-45-90 degree and 30-60-90 degree triangles.
	Procedures	<b>4.12.7</b> Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry to solve mathematical problems.	<b>4.12.7</b> Solve mathematical problems using right triangle trigonometry. (Answers do not need to be rationalized.)
	Problem Solving	<b>4.12.7</b> Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry to solve real-world problems.  <b>4.12.9</b> Construct, justify, and defend mathematical conclusions using logical, sequential, deductive reasoning supported by established mathematical principles.	<b>4.12.9</b> Determine the next step(s) or conclusion in a logical argument of a contextual real-world problem. Items should focus on the foundations of geometry, (e.g., circles, betweenness of points, lines)

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<p><b>5.8.1</b> Organize, display, read, and analyze data with and without technology, using a variety of displays including box and whisker plots. (C, P, PS)</p> <p><b>5.8.2</b> Find the theoretical probability of an event using different counting methods (e.g., tree diagrams, sample spaces, and organized lists) and compare those results with actual (experimental) results, differentiating between the probability of an event and the odds of an event. (C, P)</p> <p><b>5.8.3</b> Find the number of combinations possible in given situations using a variety of counting methods. ( P)</p> <p><b>5.12.4</b> Select and use the measures of central tendency such as mean, median, mode and variability including range, distribution and possible outliers that are appropriate for given situations. ( C, P, PS)</p>	Concepts	<p><b>5.8.1</b> Read, data using a variety of displays including box and whisker plots.</p> <p><b>5.8.2</b> Determine the theoretical probability using different counting methods.</p> <p><b>5.12.4</b> Recognize the correct use of measures of central tendency.</p>	<p><b>5.8.1</b> Items must ask a single question about a data display.</p> <p><b>5.8.2</b> Counting method must be a display and must be provided.</p> <p><b>5.12.4</b> Items may ask students to identify outlier(s).</p>
	Procedures	<p><b>5.8.1</b> Organize and display data using a variety of displays including box and whisker plots.</p> <p><b>5.8.2.</b> Find probability given the odds of an event. Find odds given the probability of an event.</p> <p><b>5.8.3</b> Find the number of combinations possible in given situations using a variety of counting methods</p> <p><b>5.12.4</b> Use measures of central tendency, variability and outliers to solve mathematical problems.</p>	<p><b>5.8.1</b> Items must ask student to select the correct display given data.</p> <p><b>5.8.2</b> Items may ask students to find either the theoretical or experimental probability.</p> <p><b>5.8.3</b> Number of combinations must not exceed 24.</p> <p><b>5.12.4</b> Items are not to use distributions.</p>
	Problem Solving	<p><b>5.8.1</b> Analyze data using a variety of displays including box and whisker plots.</p> <p><b>5.12.4</b> Use measures of central tendency, variability and outliers to solve real-world problems.</p>	<p><b>5.8.1</b> Items must ask for a comparison of data from the data display(s) or a computation of information taken from the display(s). Answer choices for items that involve questions of central tendency must focus on an incorrect reading of the display.</p> <p><b>5.12.4</b> Items are not to use distributions.</p>

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<b>5.12.5</b> Analyze the validity of statistical conclusions noting various sources of bias, misuse, and abuse of data cause by a wide variety of factors including choices of scale, probability versus odds, inappropriate uses of measures of central tendency, inaccurate curve fitting, and inappropriate uses of controls or sample groups. (PS)	Concepts	.	
	Procedure		
	Problem Solving	<b>5.12.5</b> Analyze the validity of statistical conclusions noting various sources of bias, misuse, and abuse of data cause by a wide variety of factors including choices of scale, inappropriate uses of measures of central tendency, inaccurate curve fitting, and inappropriate uses of sample groups.  <b>5.8.6</b> Make inferences and projections based on interpolations and extrapolations of data to solve real world problems.	<b>5.12.5</b> Solve contextual real-world problems. Evaluate the appropriateness of data analysis and the validity of conclusions. Determine the misuse and abuse of a given data display. Analyze arguments to determine faulty or misleading representations of data and the statistical information to identify sources of sampling errors. Differentiate among various types of data displays (purpose, clarity, and scale).  <b>5.8.6</b> Items should focus on inferences and projections (e.g., range of answers) rather than exact computations.